NOAA Technical Memorandum ERL MESA-27

ANNUAL INFORMAL WORKSHOP ON PHYSICAL OCEANOGRAPHY AND METEOROLOGY OF THE MIDDLE ATLANTIC AND NEW YORK BIGHTS

Charles A. Parker, Editor

Marine Ecosystems Analysis Program
Boulder, Colorado
June 1978

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION / Environmental Research Laboratories

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Environmental Research
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Annual Informal Workshop
on
Physical Oceanography and Meteorology
of the
Middle Atlantic and New York Bights

15-16 November 1977
Lamont-Doherty Geological Observatory
Columbia University
Palisades, New York 10964

HOST: Arnold Gordon, L-DGO

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EDITOR'S PREFACE

The 1977 workshop at L-DGO continued a series of informal gatherings which aim to foster the spirit of cooperative endeavor and exchange of information among physical researchers working on the continental shelf of the Middle Atlantic Bight. Attendance doubled that of the 1976 workshop held in Lewes, Delaware. This exceptional growth was due, in part, to the extension of invitations to scientists working in neighboring regions and in non-physical disciplines.

In addition to the keynote speech by George Mellor on modelling (the workshop theme), twenty-one scientific papers were presented and discussed as were several special reports. The closing session generated a frenzy of activity, in an attempt to cover a number of unaddressed topics of interest.

It was the organizer's intent that much of this manuscript be prepared in advance of the workshop, with the remaining preparation accomplished by the "documentation group" (organizers and rapporteurs) in near-real time and during evening working sessions. The MESA New York Bight Project provided secretarial support during the workshop to assist the documentation group and agreed to print and distribute the results. A number of factors, particularly stimulating professional camaraderie over dinner and departure schedules, precluded having the camera-ready manuscript available immediately following the workshop. Therefore, Project staff completed the task.

This report maintains the approximate chronological order of the happenings. Section 1 presents some background to the series of informal workshops and an introduction to the 1977 workshop and theme. Section 2 presents abstracts of the scientific reports (with comments and discussion recorded by rapporteurs) which occupied the majority of the two-day session. Sections 3 and 4 attempt to record the bulk of the old and new business which arose throughout the meeting but most of which occurred during the crowded afternoon of the second day. The appendices have been reserved for activity summaries, mailing list, and announcements.

Some improvements in the coherence of this year's report over last year's have been achieved; however, we still have a lot to learn (short of verbatim transcription) about capturing the essence in the informal, spontaneous atmosphere of our gatherings. While the summary may not record faithfully all discussions, it should be possible to find memory-jogging items of interest which can be tracked down and pursued further with colleagues. Hopefully, this report will stimulate the spirit of cooperative endeavor and exchange of information on the continental shelf of the Middle Atlantic Bight.

Charles A. Parker
MESA New York Bight Project
14 March 1978

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CONTENTS

Page

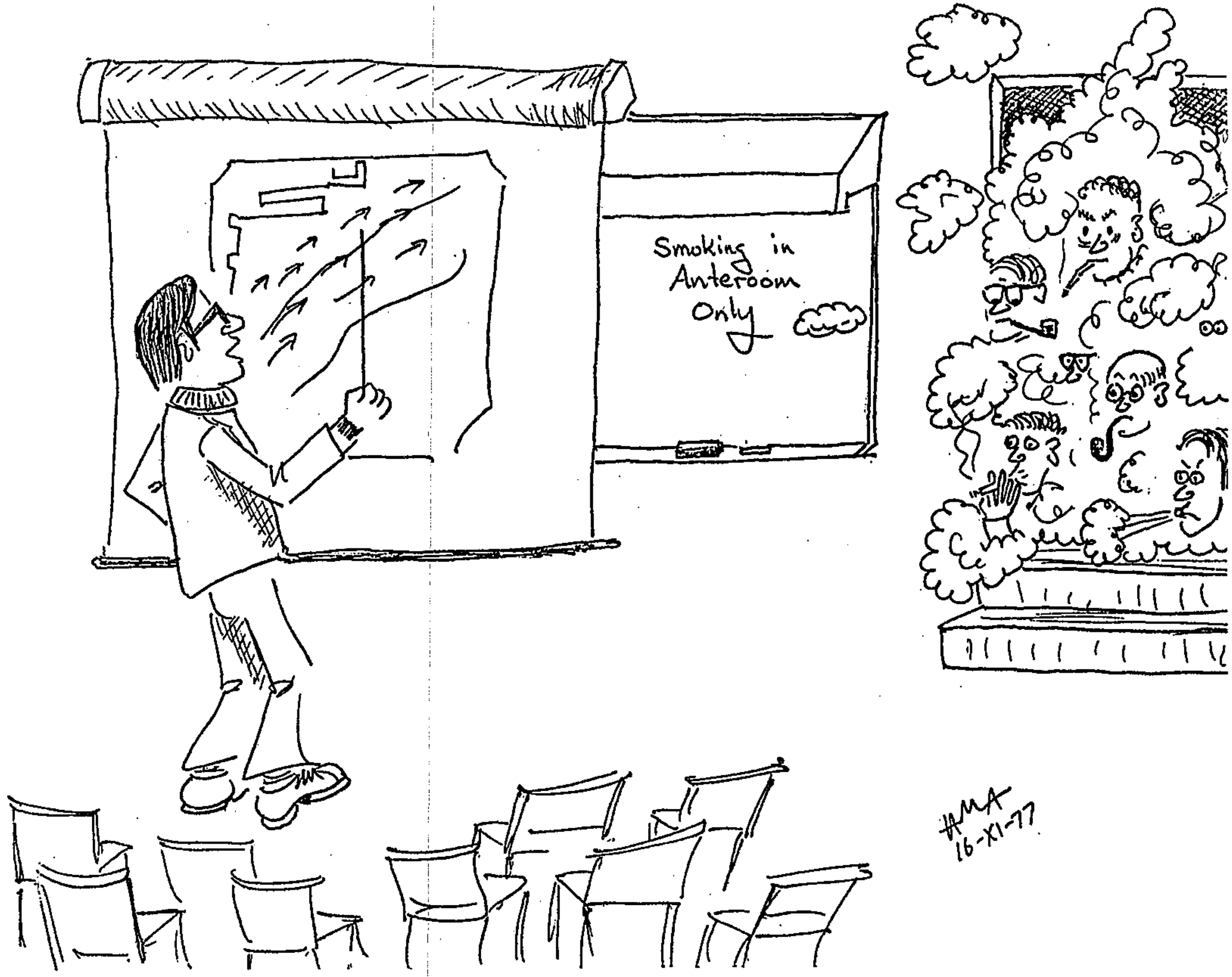
Page

ACKNOWLEDGMENTS

The publication of this report has been supported by the New York Bight Project of NOAA's Marine EcoSystems Analysis (MESA) Program. Ms. Diane DeLuca (MESA) spent long hours during the workshop deciphering the rapporteurs' hieroglyphics and entering these into the memory of the Mag Card II programmable typewriter so that editable copy could be made available to the documentation group in near real time. She also prepared the final manuscript.

While cleaning up after the 1976 Lewes workshop, the mad scribblings of a phantom cartoonist were found among the residue. As this seemed to capture the spirit, if not the substance, of that workshop, it was included as the frontispiece of last year's report. During the 1977 session, Herb Austin was observed producing similar caricatures which are dispersed throughout this report. If pressed, Herb will humbly accept credit for last year's humour.

The facilities and setting provided by Lamont-Doherty Geological Observatory and the arrangements and hospitality provided by Arnold Gordon and Ann Roy were greatly appreciated by the workshop participants.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1. INTRODUCTION

1.1 Background

The series of annual informal workshops on physical oceanography of the Middle Atlantic and New York Bights can easily be traced to the formation of an oceanographic program within the Brookhaven National Laboratory (BNL) and establishment of NOAA's MESA New York Bight Project. Some argue (and rightfully) that informal meetings took place from time to time prior to 1975; however, these new regionally-oriented programs perceived a need for harmonious co-development of programs complementary to each other and to the efforts of the broader research community active in the region. Thus, in March 1975 a meeting was held at BNL to informally discuss the two physical oceanographic programs and to learn more about other activities on the Middle Atlantic Shelf. Those in attendance (approximately 30) felt that the exchange of information was beneficial and healthy, and it was agreed that similar meetings would be worthwhile to follow up on results of the planned activities and for further coordination. The second meeting was held 20-21 November 1975 at the MESA Stony Brook Office. The occasion afforded an opportunity to pursue (over an extended dinner) an idea put forth and enthusiastically supported at the ASLO Symposium held two weeks earlier, i.e., CMICE (see Section 3.2).

An obvious but subdued theme surfaced repeatedly during the first two meetings -- viz. the physical oceanography of the Middle Atlantic Bight cannot be adequately addressed without appropriate consideration of meteorological forcing. Thus, meteorology was added to the title and set the theme for the 1976 workshop held in Lewes, Delaware on 11-12 November. The meeting was attended by 45 (75 invitees). A working group on Atmospheric Forcing of the Middle Atlantic Bight (AFMAB) was formed during the meeting (see Section 3.1).

1.2 The 1977 Workshop

The 1977 workshop was convened to review physical oceanographic research activities of the recent past and those projected for the near future in the Middle Atlantic Bight, continuing the general aims of the predeceding workshops. The invitee list (see Appendix B) was expanded to about 130 to reflect recommendation of the 1976 workshop (1) that a better job be done "to bridge the gap" between the Middle Atlantic Bight and neighboring regions, and (2) that at least a token representation of the non-physical disciplines be present "to keep us honest." Approximately 65 participants attended.

The workshop theme, "Modeling of the Middle Atlantic Shelf Circulation," was established as a result of interest expressed during the previous gathering and too little time then for adequate discussion. As it turned out, considerable continuity developed between the 1976 and 1977 workshops. AFMAB developed a circulation modeling focus, and the few modeling efforts summarized at the earlier gathering progressed nicely over the interim.

The meeting in Lamont Hall was called to order by Arnold Gordon at 0845 EDT on 15 November 1977. After introductory remarks by Arnold and Charles Parker, Don Hansen gave a two part summary of modeling and experimental research activities (Appendix A). The summary was based on the combined inputs submitted by participants prior to the workshop.

The theme of the workshop was introduced in a keynote-talk by George Mellor. He summarized various models that have been or are being applied to the Middle Atlantic Bight (Table 1). They range from Search and Rescue models and Oil Spill Trajectory models (both of which are quite simple but are nearing operational implementation) to three-dimensional unsteady, baroclinic models (which are under development). It was noted that parameterization required by the models depends on the type of model. For example, two-dimensional models with no vertical variability require horizontal diffusion parameterization, which is not required by models with significant vertical resolution. He strongly asserted the need to test the predictive power of the various models. Very little model verification has been attempted on the level of current meteorological comparisons of hindcast model prediction and observational data. Models of the Middle Atlantic Bight (MAB) must cope with open boundaries where temperature and salinity must be specified at inflow boundaries and where sea surface elevation must also be specified. Presumably MAB models can provide boundary conditions for "nested," higher-resolution models (e.g., a New York Bight model). Finally, it was noted that interaction between modeling and observational programs would be desirable but currently is a tenuous matter.

The following sections document, in some fashion, the remainder of the meeting.

Table 1. Models applicable to the Middle Atlantic Bight (MAB)

Model	Input	Domain	Dimensionality	Resolution	Algorithm	Output	References
(1) USCG (SAR) surface drift	$\vec{\tau}_s$, $\vec{u}_c$	MAB regional Model	x,y,t	∿ 25 km, 6 hr	$\vec{u}_c + a\,\vec{\tau}_s$ = u drift	u drift	Fornshell, Mooney, Frydenlund, Sandeen
(2) NOAA Oil Spill trajectory model	$\vec{\tau}_s$, $\vec{u}_s$	MAB regional Model	x,y,t	∿ 25 km, 6 hr	$\vec{u}_c + b\,\vec{\tau}_s$ = u drift	u drift	Galt[1]
(3) NOAA storm surge a. Statistical	$\vec{\tau}_s$, p, ζ tidal	selected coastal stations	t	6 hr	empirical transfer functions	ζ coast	
b. Dynamical	$\vec{\tau}_s$, p	MAB	x,y,t	stretched grid	2-D linear shallow water eqns.	ζ coast	Jelesnianski[2]
(4) Tidal Models	tidal forcing	various estuaries, inlets, Gulf of Maine	x,y,t		shallow water linear and non-linear eqns.	$\vec{u}(x,y,t)$ $\zeta(x,y,t)$	reviewed by Hinwood & Wallis[3]
with pollutant transport	pollutant sources		x,y,t		pollutant transport eqns.	C(x,y,t)	
(5) Transient, wind driven circulation	$\vec{\tau}_s$	MAB	x,y,t	10 km, 10 km, 1 min.	linear shallow water eqns.	$\vec{u}(x,y,t)$ $\zeta(x,y,t)$	Beardsley, Tingle
(6) Steady wind and density driven circulation	$\rho(x,y,t)$, $\vec{\tau}_s$ H(x,y)	a. N.Y. Bight b. MAB	a. x,y,z b. x,z	30 km, 100 km, 20 min.	Geostrophic/Ekman Diagnostic	$\vec{u}(x,y)$	a. Han, Hsueh b. Bishop & Overland,[4] Csanady, Galt[1]
(7) Transient, wind density and thermohaline driven circulations	$\vec{\tau}_s$, $T_s(x,y,t)$, or $Q_s(x,y,t)$, H(x,y) $E_s(x,y,t)-P(x,y,t)$. Lateral inflow boundary T and S	MAB	x,y,z,t	20 km, 20 km, 20 vertical grid points. (2 time steps, 1 min. and 30 min.)	Hydrostatic primitive eqns. Turbulent transport eqns.	$\vec{u}(x,y,z,t)$ T(x,y,z,t) S(x,y,z,t) $\zeta(x,y,t)$	Blumberg, Mellor

Table 1. (Continued)

Model	Input	Domain	Dimensionality	Resolution	Algorithm	Output	References
(8) Wave prediction	$\vec{\tau}_s$, H(x,y) Topography	Western North Atlantic Ocean	x,y,t	∿ 40 km, 1 hr	Prognostic, wave energy eqns.	Spectral and significant wave parameters	Galt[1], Jelesnianski[2], Hinwood and Wallis[3], Bishop and Overland[4], Cardone[5].

$\vec{u}$ = velocity, subscript c denotes climatological surface values

H = Water (bottom) depth

ζ = Sea surface height

T = Temperature, subscript s denotes surface values

S = Salinity, subscript s denotes surface values

$\vec{\tau}$ = Surface wind stress

ρ = Density

Q_s = Surface heat flux

E_s = Surface evaporation

P = Precipitation

References

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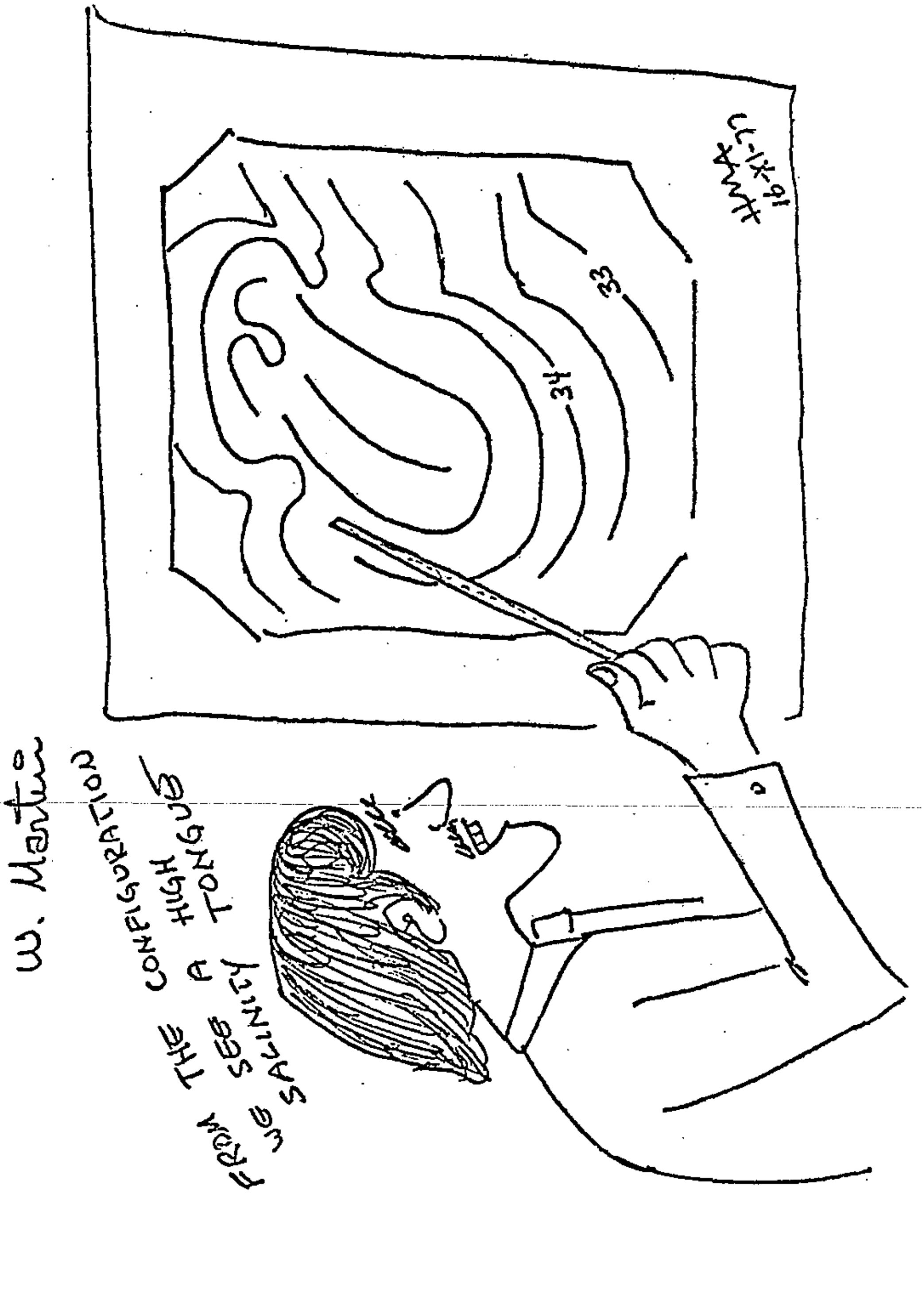
4. Bishop, J. M. and Overland, J. E., 1977. Seasonal drift on the Middle Atlantic Shelf. Deep-Sea Res., 24: pp. 161-169.
5. Cardone, V. J., 1974. Ocean Wave Prediction: Two decades of progress and future prospects. Sea Keeping 1953-1973, Society of Naval Architects and Mechanical Engineers, New York, pp. 5-18.

Note: Unreferenced authors indicate those whose work is in progress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2. SCIENTIFIC REPORTS

Twenty-one "fifteen minute" scientific presentations were given over the course of the two-day workshop. Abstracts of the talks were prepared in advance and rapporteurs were selected to distill the discussion. Some difficulty was experienced in adhering to the order and time limit of the established schedule (Appendix C), as is to be expected in any informal forum. By extending the first day's afternoon session an hour and by deferring lunch on the second day, all presentations were worked in before lunch resulting in approximately a three-hour slip in the schedule. The abstracts and discussion summaries (rapporteur's name in parentheses) that follow are arranged in the order of presentation.

2.1 Long Term Current Variability in a Midshelf Region Above the Hudson Shelf Valley, by Dennis A. Mayer.

ABSTRACT: Since so much current meter data have been collected at a particular site (nominal location 40°7'N, 72°54'W) for a period of more than three years, it is now possible to begin studies of the seasonal and interannual variations of currents and temperatures. A reasonable estimate has been made of the annual mean flow, and in addition, monthly mean current vectors have been plotted for all data. Normalized spectra of currents and spectra of detrended temperature records have been used to analyze frequencies whose periods are less than one month.

DISCUSSION: (C. Mooers) Ten months is the longest single current meter record which can be patched together from New York Bight Project data, but a variety of data exists for several years. Wind stress is greater over the water (based on buoy data) than at coastal stations, and has better defined several-day peaks, including a cross shelf diurnal sea breeze component in winter and a sea breeze component in both stress components in summer. Year-to-year variability in wintertime upshelf mean wind stress results in reversed flow patterns. Current spectra were normalized on the basis of the area under the semidiurnal energy peak for winter and summer. Inertial peaks occur in summer in the upper layer; several day-peaks occur in winter through the water column. Semidiurnal peaks occur in temperature spectra, and inertial peaks occur in temperature spectra below the surface. Based on three years data, seasonal stratification breaks down in early November and starts in late March but there is year-to-year variability in the magnitude of the seasonal temperature cycle, and in storm-driven temperature events.

2.2 Diagnostic Model of Water and Oxygen Transport in the New York Bight, by Gregory Han and Donald V. Hansen.

ABSTRACT: Oxygen fluxes in a layer below the pycnocline were calculated along transects in the New York Bight using a combination of water fluxes from a diagnostic model of circulation and oxygen concentration measurements. The fluxes were calculated over a time interval extending from 18 May to 29 June, 1976, which was selected because of a coincident sharp decrease in the dissolved oxygen concentrations in the Bight. A simple mass conservation model was used to calculate the utilization rate of oxygen in various segments of the Bight using both the observed time rate of decrease of oxygen and the divergence of oxygen flux in each segment. Results showed a specific utilization rate of -.172 ml/l/day of oxygen in the segment off New Jersey which is three times larger than in the comparable area off Long Island, and ten times greater than on the outer shelf. Water flux was southeastward at an average of $91 \times 10^3 m^3/s$ in the lower layer which transported 747 kg O_2/s into the Bight.

The circulation in the Bight was organized such that a strong convergence and upwelling occurred in the Bight Apex during 31 days of the interval and off New Jersey for 21 days of the interval which would kinematically lead to a concentration of organisms and organic material in these regions. This mechanism is offered as a partial explanation of why the anoxia occurred off New Jersey and in the Apex and not off Long Island.

DISCUSSION: (C. Mooers) Shelf flow can reverse in six hours with a significant change in wind stress. For the summer 1976 anoxia event, the inner shelf off New Jersey and the New York Bight Apex were regions of net bottom layer (below pycnocline) convergence in dissolved oxygen. This resulted in twice as much net dissolved oxygen consumption than that based on only the time rate of change of total volume of dissolved oxygen. Results of diagnostic model analyses are being documented in a NOAA/MESA Professional Paper to be published in 1979.

2.3 Long Wave Models of Currents in New York Bight, by Y. Hsueh.

ABSTRACT: Model computations of bottom currents on the continental shelf in New York Bight are made on the basis of a long-wave approximation to the vorticity equation for a barotropic flow. Resistance of the shelf bottom to the flow is incorporated with the specification of a bottom stress that is proportional to the bottom geostrophic velocity. The model is driven by observed winds at John F. Kennedy Airport and by disturbances in bottom currents observed at two locations on the Long Island shelf. Comparison of the model results with observations at two locations on nearly the same isobaths off New Jersey shows that, at the inshore location, almost half of the observed longshore variance in longshore currents becomes accountable when a bottom resistance coefficient of .05 in cgs units is used. At the offshore location, only 20% of such variance is model-accountable. Coherence analyses also show that the model generates bottom current time-series the content of which at low frequencies (< .09 cpd) are statistically identical to those observed.

DISCUSSION: (C. Mooers) On storm time scales, alongshore coherence in alongshore flow is high but there is low cross-shelf coherence for cross-shelf flow. Therefore, prediction possibilities are high for alongshore flow but low for cross-shelf flow, on storm time scales. This observational deduction was verified in a time-dependent (prognostic) model which includes surface- and bottom-Ekman layers. Also verified was downshelf propagation for time scales longer than 10 days (storm time scale, <10 days, propagate upshelf). Strong local wind response was shown at the head of the Hudson Canyon. Possibilities exist for calculating bottom stress time-series and spectra at various spatial points.

2.4 Remote Acoustic Sensing of Physical Processes in the Ocean, by M.R. Orr and F.R. Hess.

ABSTRACT: A short discussion will be presented describing the use of high frequency acoustic backscattering systems to detect mixing processes, shelf-slope water intrusion zones, internal wave packets, coherency of internal wave fields, and natural particulate distributions within the water column.

DISCUSSION: (D. Hansen) Use of high frequency acoustical backscatter to observe: temperature, turbulence, particles, and large biological organisms. Observations from Hudson Canyon shown. Observations from Massachusetts Bay internal waves shown.

2.5 Shelf-Slope Exchange, by Arnold L. Gordon.

ABSTRACT: The average annual flux of fresh water into the Middle Atlantic Bight by both rivers (Bue, 1970) and excess evaporation over precipitation (about 40 cm/year, Jacobs, 1950) would lower the average salinity of the shelf waters enroute from Cape Cod to Cape Hatteras by 1.3 $^{o}/_{oo}$, were there not a net onshore salt flux. The average annual volume flux of slope water (35 $^{o}/_{oo}$) necessary to fully balance the fresh water input is 1,947 km^3/yr, yielding a shelf water (33%) production rate of 2,065 km^3/yr. This is slightly smaller than that estimated by Wright (1976) (2,400 km^3/yr) who believes open sea evaporation equals precipitation. It is noted that the fresh water input is highly seasonal and yearly variations are significant.

The onshore flux of slope water and the offshore flux of shelf water may occur by a number of processes. The offshore flux of shelf water at Cape Hatteras (Parker, 1976; Kupferman and Garfield, 1977) may balance the total production of shelf water. Impingement on the continental slope of anti-cyclonic Gulf Stream eddies may also evacuate some shelf water across shelf-slope boundary; Morgan and Bishop (1977) estimate a shelf water loss of 208 km^3/yr, or about 10% of production rate. A third mechanism is escape of shelf water by cold pool calving (Wright, 1976), though this may be related to anti-cyclonic eddy events.

Onshore flux of slope water may be more difficult to explain. Wholesale advection of slope water onto the shelf does not seem to occur during anti-cyclonic eddy events (Morgan and Bishop, 1977, IR satellite views of the sea surface), though a recent aircraft IR survey has shown some onshore motion. The upper thermocline intrusions of saline slope water, induced by Ekman drift (Boicourt and Hacker, 1976) or perhaps instability of shelf-slope frontal zone, is a wide-spread feature.

Further fine-scale interleaving (Voorhis _et al._, 1976; Gordon _et al._, 1976) is common within the frontal zone. The effectiveness of these "leaves" in regard to salt transfer is difficult to evaluate without detailed experimental work, but estimates of life-time of 1 to 3 days (Voorhis _et al._, 1976; Horne, 1977) suggest that these features can account for much of the necessary slope water flux. Further mechanisms of onshore flux may be related to benthic intrusions (Gordon _et al._, 1976), possibly associated with activity within the canyons (Amos _et al._, 1977).

Once slope water enters the outer shelf positions, it mixes with inner- and mid-shelf water quite rapidly. Using a cross-shelf salinity gradient of 2 ‰/60 km (for mid-shelf) and requiring an onshore salt flux of 3.9×10^{15} gm/yr along the Middle Atlantic Bight, with an average mid-shelf depth of 50 meters to balance the river inflow, the necessary lateral mixing coefficient is 7.5×10^{5} cm^2/sec. Ekman drift, isopycnal mixing, and Hudson Channel flow in conjunction with storm produced mixing, may be effective means of cross-shelf salt flux.

DISCUSSION: (D. Hansen) Discusses shelf-break exchange flow (2×10^3 km^3/yr) required for salt balance in Middle Atlantic Bight. Intrusion and interleaving thought to be important salt flux mechanism. Discussion centered on use and interpretation of box models.

2.6 Distributions of Dissolved Rn-222 and Suspended Particulates, by Pierre E. Biscaye and Steven R. Carson.

ABSTRACT: The geochemistry research program has continued through CY 1977 with field, laboratory, and data analysis work focusing on the distributions of dissolved Rn-222 and suspended particulates. Rn-222 is a radioactive inert gas (half life ∿ 4 days) produced by the decay of Ra-226 in the water column and in the sediments. The distribution of Rn-222 in excess of that in equilibrium with dissolved Ra-226 is dependent upon the flux of Rn from the sediments, the advection-diffusion field of the water and the rate of loss to the atmosphere which can produce Rn deficiencies in the upper water column. Rn serves as a tracer of conservative, dissolved substances and it is our intent to use the distribution of excess Rn for the determination of mixing parameters in N.Y. Bight and their effect on the transport of dissolved and particulate matter.

There have been six cruises on which hydrographic properties, Rn-222, Ra-226, suspended particulates and sediments were sampled. The three in CY 1977 were 1) KELEZ 7702 in late March which emphasized horizontal resolution in the Hudson Shelf Channel region, 2) CAPE HENLOPEN 7707 in early May which was a broad survey in N.Y. Bight and the adjacent slope emphasizing detailed vertical profiles, and 3) CAPE HENLOPEN 77-15C which was an attempt to relate the Rn distribution near the Channel to the drift of deep drogues.

The major features of the observed Rn and particulate matter distributions are 1) the fine-grained sediments of the Channel, slope and south of R.I. are stronger sources of Rn than most of the coarser-grained sediments of other areas; 2) the distribution of both Rn and suspended particulates can be correlated with the distribution of fine-grained sediments and to the Rn source strength, except on the slope where both excess Rn and particulate concentrations are anomalously low. A three-dimensional model has been developed by Dr. Nevil Milford which calculates the dissolved Rn distribution produced solely by diffusion with various combinations of horizontal and vertical diffusion rates from the N.Y. Bight source distribution on a flat bottom. Simple calculations have also been performed on Rn profiles from three cruises placing limits on vertical diffusion constants.

DISCUSSION: (D. Hansen) Discusses use of Ra-226 and Rn-222 for study of vertical mixing over the shelf. Rn-222 tends to accumulate under the pycnocline. Maximum accumulations are found in the vicinity of and just south of the Hudson Shelf Valley and off Long Island, mostly in association with fine sediments.

Finds vertical mixing coefficients of .01 to .3 cm^2/sec in the pycnocline, 100 to 300 cm^2/sec in bottom mixed layer; determined from an implied model in which upward diffusion is balanced by decay.

2.7 Time and Space Variability of Interleaving Structure at the Shelf Break in the New York Bight, by Robert W. Houghton.

ABSTRACT: Interleaving of shelf and slope water is frequently observed at the shelf/slope front in the New York Bight around the perimeter of a warm core eddy. We will present analysis of CTD casts taken during a cruise near the Hudson Canyon in May 1977. In addition to sections from the New Jersey and Long Island coast across the shelf break, a series of stations taken every three hours at two locations 20 km apart on opposite sides of the shelf/slope front at the shelf break produced a time series that allows a rough analysis of the time and space scale of variability of the interleaving.

A distinct intrusion of slope water (10 m thick) onto the shelf was observed with $\Delta T \sim 2^{\circ}C$ and $\Delta S \sim 0.5\ {}^{o}/_{oo}$. A corresponding structure was observed 20 km seaward on the slope. Perhaps the horizontal shear instability in the boundary between the eddy and the prevailing SW flow over the shelf is one mechanism by which the intrusions are initiated. Estimates of heat and salt fluxes by double diffusion imply a lifetime for this intrusion of 1-2 days. Associated with this intrusion are small scale instabilities. Successive CTD uptraces taken 10-minutes apart reveal significant and rapid changes in the structure. However, the major cause of variability in successive CTD casts (in the absence of storms) is mostly the result of horizontal tidal advection. It is noted that the fluctuation of the water type observed near the front has both diurnal and semi-diurnal periodicity.

In order to study the evolution of these interleaving structures, sampling with time intervals not greater than 2 hours or space scales of 1 km is required.

DISCUSSION: (D. Hansen) Described some temperature profile time series in outer New York Bight. Shows that variability is important on scales of a few kilometers and a few hours. Structure in STD casts are not reproducable on time scales of 30 minutes.

2.8 Oceanographic Analyses from Data in the National Archives, by Robert Williams, Fredric Godshall, and Joseph Bishop.

ABSTRACT: For the purpose of providing historical information to aid in the protection of the Mid-Atlantic Bight environment during exploration and development of petroleum resources in the continental shelf lease areas, the Environmental Data Service was requested by the Bureau of Land Management to summarize and interpret meteorological and oceanographic data in the National Archives. This mid-Atlantic study provided the opportunity to critically evaluate the usefulness of national oceanographic and meteorological data archives for these analyses. Different data of a common variable were examined, such as the XBT, MBT and STD data files, to determine the homogeneity of a combined data set. Alternative data sources and data files were compared for the purpose of defining data accuracy and identification of biases. Short-period data variances were compared to seasonal and annual variations to determine the limits on resolution of periodic changes. The data bases were evaluated in terms of suitability for performing analyses of physical oceanographic fields (surface currents from ship drift, temperature, salinity, density), limits to water mass identification, and specification of internal gradients and fronts. Water quality analysis in terms of analyses of nutrient and dissolved oxygen concentrations showed that these data were inadequate for the purpose of establishing benchmarks of water quality for future evaluations of change. The "Marine Deck" observations served as the data source for wave climatology and offshore wind fields. The quality of these data is compared to coastal and buoy observation records.

DISCUSSION: (D. Hansen) Described methods and problems encountered in working up environmental description of Middle Atlantic Bight from archived data. Techniques included principal component analysis, temperature-depth histograms, surface temperature distributions, mean profiles of properties (combining non-uniform data sets produces spurious structures in the mean profiles), and set and drift current maps.

2.9 Synoptic Study of the Shelf Water/Slope Water Front's Mesoscale Structure, by Christopher N.K. Mooers.

ABSTRACT: A cruise along the continental shelf break ($\sim$ 100 m isobath) between Ocean City, MD and Atlantic City, NJ ($\sim$ 200 km alongshelf by 50 km cross-shelf) was conducted in July 11-21, 1977. The cruise was organized into three legs, each of 2.5-day duration. Legs I and III

focused on synoptic time and space scale hydrography, relying primarily on XBT data, plus a limited number of water samples and shallow CTD casts.

The surface temperature and salinity fields were marked by the presence of two warm core Gulf Stream eddies, labeled 'L' and 'P' on the U.S. Naval Oceanographic Office Experimental Ocean Frontal Analysis charts. In addition to strong alongshelf and cross-shelf variability on a 10 to 30 km scale, the surface temperature also showed considerable variation between legs. The surface mixed layer was about 10 m thick on average but ranged between about 2 and 20 m. The bottom mixed layer was about 20 m thick on average but ranged between about 10 to 30 m.

The most notable features of the subsurface temperature field were the 'cold pool' on the shelf between the 80 and 100 m isobaths and the thermal front along the shelf break. Temperatures as low as 5.1°C were recorded in the 'cold pool'. The most intense portion of this pool, as defined by the 6°C-isotherm along the bottom was 80 km alongshelf by 14 km cross-shelf during leg I and 50 km alongshelf by 7 km cross-shelf during leg III. The core of the 'cold pool' was generally well-mixed over a thickness of about 30 m.

The thermal front along the shelf break was a weak surface feature but a strong and lightly variable subsurface feature. In some locations a 10°C-temperature change occurred in a distance of 2 km, while in other locations a corresponding temperature change occurred over 20 to 30 km. In several instances, the isotherms defining the front extended down the continental slope to a few hundred meters.

DISCUSSION: (R. Patchen) There will be a current measurement working conference January 11-13 at Newark, Delaware. A pilot study was conducted to investigate the shelf/slope water exchange. Are warm core eddies possible mechanisms for exchange? Temporal changes are shown to be large. How do you interpret the results of a single cruise? The bottom mixed layer is less variable than the surface mixed layer. The mixed layer thickness is indicated by the point at which the curvature changes in the XBT traces.

2.10 Hydrographic Reconnaisance of the Wilmington Canyon's Impact on the Shelf Water/Slope Water Front, by Wayne W. Martin.

ABSTRACT: The hydrography of the Wilmington Canyon was studied in detail during the middle leg of a cruise along the shelfbreak front and, on the second leg, the effect of a submarine canyon on the front was examined. Seventy-five XBT casts were made, along with a limited number of shallow CTD casts, over an areal grid encompassing the Canyon.

Temperature profiles show that, although a weak surface feature, the front is clearly delineated in the onshore-offshore subsurface thermal structure. The front has strong alongshore variability across the Canyon. An extended drooping "tongue" of 8°C water and several

small isothermal "bubbles" (1 to 2 km onshore-offshore, 10 km alongshore, and 10 to 30 m thick) suggest that the canyon area is active in the mixing of shelf and slope water by the process of "calving".

DISCUSSION: (R. Patchen) Three cross-sections and an extensive grid in Wilmington Canyon were used to show cross-shelf variability. An 8° "tongue" extruding from the shelf is a definite feature. This indicates an area of strong interleaving. Winds during the experiment were almost nil, however, previously the winds were in a direction favorable for upwelling. Arnold Gordon noted that warm anti-cyclonic eddies which are observed by the Gulf Stream may "advect" shelf water to the Gulf Stream boundary. The frontal structure was not well defined at this site during this period. To call it a "tongue" was questioned by Bob Beardsley. John Ruzecki showed results from a survey performed in Norfolk Canyon. His results indicated a similar feature, with 11° water, which he called a "tube."

2.11 Small Scale Study of the Shelf Water/Slope Water Front's Convergence Zone, by Richard W. Garvine.

ABSTRACT: During the second leg of a July 1977 shelf break front cruise, a section across the frontal zone was investigated by closely-spaced XBT casts, aircraft-tracked surface drifters, shallow CTD casts, and surface thermosalinograph tracks.

Aircraft operations involved four hours of photographic tracking of a series of 31 color coded surface drifters. Preliminary results indicate zones of significant surface convergence and shear. Estimations of the vertically integrated velocity were made by photographic observations of Richardson dropsondes.

In the area of the observations, were eight closely spaced surface bands which were delineated most clearly by changes in surface roughness. Temperature profiles from XBT casts in the area suggest an active internal wave structure in the area. (A nautical chart indicates that this area is characterized by "tidal rips".) Several passes along a 40-km cross-shelf section were made to investigate the horizontal and temporal variability of the temperature field by the use of XBT's.

DISCUSSION: (R. Patchen) The second leg of the cruise included fine scale hydrography. A "glitch" (10 m vertical displacement of isotherms) was noticed by Arnold Gordon which was denied to be a measurement error by Garvine. Corresponding roughness bands were found on the surface at the location of the glitch. These bands might be an indication of internal wave activity. Marshal Orr stated that he had slides of an internal wave in an eddy in the area of interest. The bands were observed by Garvine to be parallel to the shelf break and were about 100 m apart. Eight were seen. Wind conditions were similar to condition during Orr's observations. Tide rips are noted on the nautical charts which might indicate the bands are tidally related. Don Hansen stated that they occur at semidiurnal frequencies. A surface shear step structure was seen from a plume of dye released by surface drifters. A maximum speed of 50 cm/sec and a minimum speed of 25 cm/sec toward the northeast were calculated. The maximum speeds occurred along the shelf break. Bob Beardsley noted that Brad Butman has shown the same phenomenon.

2.12 Forcing Mechanisms of the Shelf-Slope Front from the Chesapeake Bay through Georges Bank, by George R. Halliwell, Jr.

ABSTRACT: A project has been undertaken at the University of Delaware to use a data product derived primarily from thermal infrared satellite imagery to study the subtidal frequency forcing of the shelf-slope front between Chesapeake Bay and the Northeast Channel. Two years of weekly experimental ocean frontal analysis charts produced by the U.S. Naval Oceanographic Office (September 3, 1975 through August 24, 1977) were used to digitize time series of the displacement of the surface locus of the shelf-slope front relative to the shelf break, time series of the displacement of the Gulf Stream relative to a reference line parallel to the Stream, and time series of the position and size of all warm-core anticyclonic eddies. Meteorological data from several U.S. and Canadian coastal stations and data buoys will be used to compute time series of the along- and across-shelf components of wind stress. The shelf-slope front data will then be statistically compared to the data sets of the three potential forcing mechanisms (winds, Gulf Stream, anticyclonic eddies) to better understand how perturbations of the front are forced. An empirical orthogonal function analysis is being performed on the data sets to study the spatial and temporal structure of the dominant modes of the variability. A cross correlation analysis is being performed between the time varying amplitudes of the dominant modes of the front and each of the other data sets to determine how each mechanism may be forcing the observed meanders of the front. In addition, the space-time cross correlation field is being computed for each data set to obtain quantitative information about the space and time scales of the variability plus the average phase speed of propagating disturbances. A summary of early results of this aspect will be presented. The time series of the shelf-slope front locus contain a strong signal from the offshore entrainment of near-surface shelf water by anticyclonic eddies. From the space-time cross correlation field of the front, disturbances propagating to the south and west along the shelf break at an average speed of 5 to 8 cm/sec are identified. The average space and time scales of the perturbations are approximately 100 km and 4 weeks, respectively. For the Gulf Stream, disturbances propagating downstream with an average phase speed of about 7 cm/sec, plus weak disturbances propagating upstream with the same phase speed are indicated. The average space and time scales for the Gulf Stream meanders are about 180 km and 3 weeks, respectively. Empirical orthogonal functions have been computed for both the shelf-slope front and the Gulf Stream. The spatial structure of the two dominant modes of the front, which account for over 50% of the total variance, show large variance at Georges Bank and little variance elsewhere. Most of the dominant modes of the Gulf Stream show increasing amplitude of the meanders downstream from Cape Hatteras. Cross-correlations between all pairs of time varying amplitudes of the dominant modes of

the front and Gulf Stream will be presented to demonstrate evidence for or against forcing of the front by the Gulf Stream.

DISCUSSION: (R. Patchen) NAVOCEANO frontal analysis charts were used to define the structure and variability of shelf/slope front. Phase speed for the frontal disturbances is $\sim$6 cm/sec in a SW direction in 1976. The results indicate that the sampling period must be less than a month and that the spatial resolution must be at least 100 km. Phase speed propagation of the Gulf Stream frontal disturbances is 7 cm/sec, with basically the same scales necessary. It was stated that eddies stall and move towards Georges Bank. A possible coupling between fronts and the Gulf Stream was demonstrated.

2.13 Efforts of the Atlantic Environmental Group (AEG) to Construct an Environmental Data Base for Fishery Climatology Studies in the Cape Cod-Cape Hatteras Area, by Merton C. Ingham.

ABSTRACT: Various sets of time-series environmental data, both meteorological and oceanographic, are being accumulated by the Atlantic Environmental Group of the National Marine Fisheries Service for use in fishery climatology studies. These data include:

1. Wind stress and Ekman transport from FNWC/PEG
2. Sea surface temperature from NCC/FNWC/PEG
3. Tide station water temperature data from NOS
4. Nantucket Island meteorological observations from NCC
5. Subsurface temperature (XBT) and surface salinity and temperature data from ships of opportunity
   a. Across the continental shelf out of New York
   b. Across the continental shelf along 71°W
   c. Across the continental shelf out of Norfolk, Va.
6. Bottom temperature recorder data from the outer continental shelf off southern New England from fishing boats.

DISCUSSION: (R. Beardsley) There were several questions on how to obtain copies of several AEG output products. Situation varies among products, so AEG should be contacted.

2.14 Operational Marine Environmental Prediction Programs of the Techniques Development Laboratory by N. Arthur Pore and Celso S. Barrientos.

ABSTRACT: The Techniques Development Laboratory of the National Weather Service began developing automated marine environmental prediction programs in 1965. These programs are organized into three tasks -- oceanic forecasting, coastal forecasting, and Great Lakes forecasting. The eight programs which are used for operational forecasting are briefly described. They are programs for forecasting ocean waves, extratropical storm surges, hurricane storm surges, coastal winds, beach erosion, Great Lakes winds, Great Lakes waves, and Lake Erie storm surges. A program to develop operational oil spill trajectory forecasts is in progress. The oil spill project covers a wide range of developments in boundary layer meteorology and coastal oceanography.

DISCUSSION: (R. Beardsley) Several questions and discussions covered verification of the TDL forecasts. Generally, verification efforts were sporadic, limited, and subjective. The dynamics program SPLASH is used for hurricane storm surge forecast where statistical methods are used for routine conditions. The reasons, principally economical, and the extent of the data base for using both were discussed, as well as the possibility of obtaining coastal currents and transport from SPLASH.

2.15 Oil Spill Trajectory Forecast, by Kurt W. Hess.

ABSTRACT: The oil spill trajectory forecast project attempts to model the time-varying nature of oil slicks on the sea surface. Transformations of the spill are greatly influenced by wind stresses and movements of the underlying water. To aid studies of the ARGO MERCHANT spill off the Massachusetts coast, a simple two-layer wind-driven barotropic model of the adjacent waters is being used for advection of the slick. A spatially-uniform wind field, based on observations, is used. The petroleum is allowed to drift laterally, diffuse, evaporate, and move by surface tension. Sinking, density-aging, emulsification and other exotic behavior are neglected.

DISCUSSION: (R. Beardsley) Discussion mainly centered about some recent results from the ARGO MERCHANT case study in which model results could be compared to periodic aircraft observations.

2.16 Progress in the Development of a Three-Dimensional Baroclinic Model of the MAB, by Alan F. Blumberg and George L. Mellor.

ABSTRACT: A three-dimensional model capable of simulating the dynamics of the MAB is currently under development. The prognostically calculated variables are surface elevation, velocity, temperature, salinity, turbulent kinetic energy, and turbulent macroscale. The model employs a coordinate transformation in which the surface and bottom become coordinate surfaces. The governing equations are split into two modes, one containing the vertically integrated equations and the other containing the vertical structure equations. This separation is desirable in terms of computer economy. Turbulence effects are incorporated through a "Level 2 1/2" turbulent closure model.

The vertically integrated equations are the nonlinear, shallow water wave equations when integrals involving vertical variances are discarded. These equations have been integrated forward in time using various boundary conditions along the seaward open boundaries. The various conditions include 1) zero surface elevation, 2) a Sommerfeld radiation condition, and 3) a modified version of the radiation condition. The model was forced by an impulsively applied homogeneous, west-northwesterly wind. The first boundary condition reflected waves back into the computational domain yielding unrealistic velocities on the shelf near the open boundaries. The second type of boundary condition performed well at first, but for long integration times the basin emptied.

A modification to this boundary condition prevented this deficiency and constituted the third type of boundary condition.

DISCUSSION: (D. Hansen) An elaborate set of nested numerical models using 14 equations and 14 unknowns was described, and examples of preliminary application to MAB, New York Bight, and Long Island nearshore were shown. All tests to date seem to have addressed barotropic flow. Presentation and discussions revolved around details too esoteric to be adequately covered in a brief summary. The work is still developmental, hardly ready for comparison to nature or application to environmental problems.

2.17 Coastal Water Variability on the Mid-Atlantic Bight, by Dong-Ping Wang.

ABSTRACT: Low-frequency sea level and atmospheric forcing on the Mid-Atlantic Bight were examined over a one-year period (1975). Evidence for coastal-trapped waves along the southern Bight, was found. Along the northern Bight, the sea level fluctuations consisted of two components, driven respectively, by the Ekman effect and the wind set-up.

Results of this study suggest that transient processes must be carefully treated in numerical modeling.

DISCUSSION: (D. Hansen) Described analysis of sea level fluctuations in the MAB and their relationship to winds. Found that sea level is relatively active in the Apex of the New York Bight. Also showed that where atmospheric pressure patterns propagate eastward, sea level fluctuations propagate southwestward. From Sandy Hook eastward, sea level responds directly to local forcing. From Sandy Hook south, direct correlation of sea level to local wind is poor; fluctuations seem to propagate along coast from the east into this area. It was suggested that their results may be artifact of the particular data set (1975) used in the analysis. Many of these time dependent behavior features reflect results from the time-dependent model reported by Hsueh on 11/15/77.

2.18 Further Studies of the Circulation in the Middle Atlantic Bight Using Box Models, by Stuart Kupferman and Katherine Bush.

ABSTRACT: A previous box model study of the Middle Atlantic Bight using salinity and Cs-137 as tracers (Garfield, 1977) gave results for the transport of Northern Shelf (Georges Bank, Gulf of Maine) water into the MAB shelf region that were in good agreement with current meter measurements of this transport. The model to be described here uses salinity and heat content as tracers. Results from this model are in good agreement with Garfield's results and offer the possibility of estimating near surface slope water and northern shelf water transports into the MAB shelf region and the rate of formation of MAB shelf water from historical hydrographic and BT data. Difficulties in verifying these hindcasted transports are discussed.

DISCUSSION: (D. Hansen) Evaluates transport of water into and out of MAB from observed values of river input, salinity, and temperature. Also evaluated sensitivity of results to error in determination of representative salinity. Estimates that historic variation of the transports may be obtainable from archive data to an accuracy of 30%. Suggestions were made for further evaluation of the meaning and sensitivity to sectional-and bulk-average concentration values.

2.19 Spreading and Mixing of the Hudson River Effluent into the New York Bight, by Malcolm J. Bowman.

ABSTRACT: Results are presented from three Hudson River plume sampling cruises made in the New York Bight in August 1976.

The data show that the set and shape of the spreading effluent vary widely over time periods of six days, and are clearly influenced by local wind stress.

Application of Takano's model of a steady state plume spreading into a stagnant ocean suggests a horizontal eddy viscosity of 10^6 cm^2/sec and a strong anticyclonic deflection of the plume. This value is considered to be an overestimate since interfacial shear stress is neglected in the model.

More careful measurements and calculations are needed to separate out the effects of horizontal and vertical viscosities, coriolis force, advection by a prevailing coastal current, and local wind stress on plume dynamics.

DISCUSSION: (P. Eisen) A case study of the Hudson River plume; three one-day cruises measuring temperature salinity, chlorophyll and sometimes nutrients. Only the first cruise had depth profiles.

Cruise 1, August 13, 1976, shows that the plume comes within a few kilometers of Long Island beaches. Cruise 2, August 16, 1976, shows that the plume is more southerly. Cruise 3, August 19, 1976, shows that the plume is along NJ coast in a narrow band. The main conclusion drawn is that wind stress is very important in the movement of the plume.

A set of equations describing plume dynamics was presented and applied to Case 1 to provide a basis for a discussion of plume dispersion characteristics.

2.20 Fine Structure and Instability in the Shelf/Slope Front, by Eric S. Posmentier.

ABSTRACT: Houghton, in an early talk, presented data showing transient interleaving of shelf and slope water at the front between these two water masses in May 1977 in the New York Bight. At both stations where this interleaving occurred, unstable stratification existed immediately

above the cores of two leaves of warm, saline slope water, which alternated with leaves of cool, fresh shelf water. These unstable regions were in the lowest portion of layers in which double diffusion might be an important process. Double diffusion can explain both the observed instabilities and curious loops observed in T-S diagrams of these stations' data. Salinity and temperature fine structure in the layer above the cores of slope water leaves are further evidence of double diffusion. Salt fingering is a possible mechanism below the cores of slope water leaves. Both double diffusion and salt fingering can greatly accelerate the mixing between leaves and thereby enhance the larger scale mixing across the shelf-slope front.

DISCUSSION: (P. Eisen) A look at the shelf/slope front and its fine structure. There seems to be interleaving of shelf and slope water. Also, the data indicate thin layers (> 5 meters) which are unstable. A presentation of double diffusion and salt fingering layer concepts was used to explain the fine structure of temperature and salinity diagrams.

2.21 Strong Gulf Stream Eddy Currents Indicated by Losses of Crab Traps on the Continental Slope, by J. Lockwood Chamberlin.

ABSTRACT: During recent months, the strong currents of Gulf Stream eddies have apparently been causing temporary or permanent losses of gear used for red crab fishing, as well as difficulty in deepwater lobster fishing off the Middle Atlantic coast. Woody Chamberlin has learned of three instances of gear loss, each associated with a different eddy. Mr. William D. Whipple, High Sea Corporation, Fall River, Massachusetts, lost 80% of his red crab gear at the end of August, south of the Hudson Canyon, when strong currents submerged the surface floats, causing them to deflate. He has so far recovered one of four trawls that were lost. The traps themselves had apparently not moved from where they were set. Whipple, who was referred our way by Fred Lux, has provided us with the above information.

The following information concerning crab and lobster fishing out of Delaware, was received by phone from Mr. Howard Seymour, Marine Extension Agent, University of Delaware, Lewes, Delaware:

-- All crab gear was lost north of Washington Canyon during the last week of June and the first week of July (one boat - 120 pots). All was recovered two weeks later when the surface floats were found northwest of where they were set. The gear had dragged 5 miles.

-- All crab gear was again lost in the same area during the third week of September (3 boats - 290 pots). No recoveries reported at the time of this writing (October 5), because of bad weather.

-- On both occasions when crab gear was lost, lobster fishermen at Norfolk Canyon as well as at Washington Canyon, encountered such strong currents, estimated at 2-3 knots, that their surface floats were held several feet or more below the surface, making location and recovery of gear difficult, and tripling the normal time to haul a string. The strong currents at Norfolk Canyon have started about 4 days later than at Washington Canyon. The lobster fishermen have started using heavier line in their trawls and more scope in their float lines.

The fishermen blame the gear losses and difficulties on strong currents, rather than on interference by other vessels, and they say that they have not experienced comparable difficulty in past years. Wind has apparently not been an important factor in the currents, but in each of the three instances of gear loss, an eddy has been adjacent to the area of the loss. What has been happening is consistent with the prevalence of eddies this year -- about double the number in each of the previous three years.

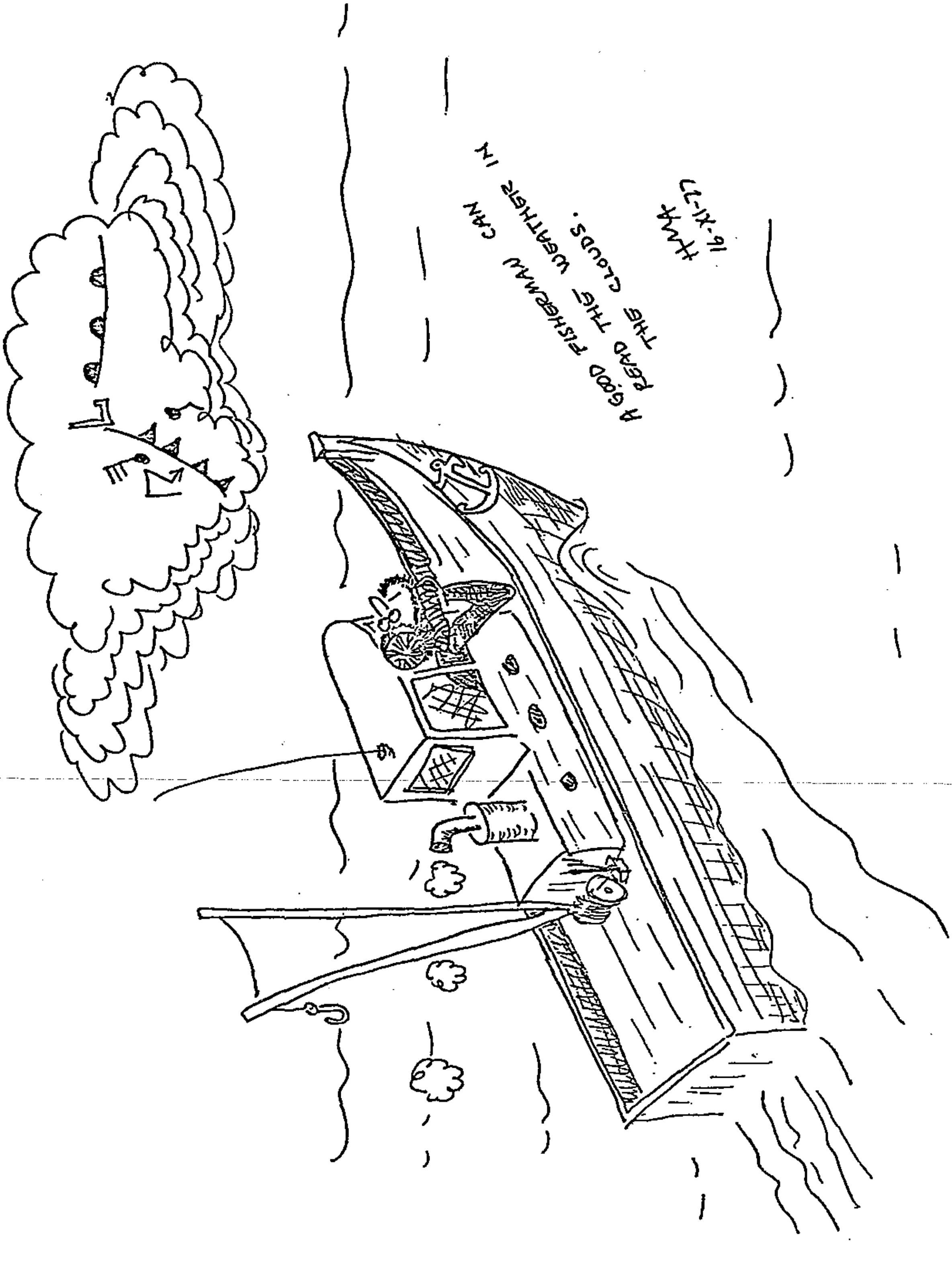
DISCUSSION: (P. Eisen) Warm-core anticyclonic eddies in Middle Atlantic Bight have been followed since 1974. Eddies tend to approach the slope more in the vicinity of Hudson Canyon. Usually the eddies form east of 70°W, around the Georges Bank area. In 1977 one eddy did form to the west of 70°W.

Crab (deep sea red crabs) traps and their loss due to strong currents was also discussed. The hypothesis at this stage is that the eddies are primarily responsible for gear loss. A few cases of known trap losses were examined and eddies were found to be in the vicinity.

2.22 Cyclesonde Measurements in the New York Bight, by John C. Van Leer.

ABSTRACT: During the last week in May 1974, 1,386 profiles of current and temperature vs. depth were made in the New York Bight Apex Region (73°47.5'W and 40°19.5'N). These profiles were recorded using a moored MK I Cyclesonde which profiled from 12 to 45 meters. These data are summarized in contour diagrams in depth and time coordinates together with mean profiles. These data show complex time-dependent vertical structure dominated by the semi-diurnal tide along the north-south axis of the Ambrose Channel and diurnal tide transverse to the channel. While the complex vertical structure of currents in the seasonal thermocline was expected, the mid-depth complexity seems large in view of the weak stratification.

DISCUSSION: This paper was not presented since John Van Leer was participating in a field program at the time of the meeting.


A GOOD FISHERMAN CAN READ THE WEATHER IN THE CLOUDS.
HMA
16-XI-77

3. OLD BUSINESS

3.1 Working Group on Atmospheric Forcing of the Middle Atlantic Bight (AFMAB)

Because of time limitations and a wealth of business to conduct during the closing session, Chris Mooers gave an abbreviated status report on AFMAB. The following amplifies his report to give a more complete perspective of AFMAB.

3.1.1 Background

The idea for and formation of an AFMAB Working Group arose out of a general discussion (during the 1976 workshop) of major open questions and information requirements (as perceived by the oceanographic community) in the meteorology and meteorological forcing of the Middle Atlantic and New York Bights. Lack of a comprehensive inventory of pertinent meteorological variables, diverse data sources, a multitude of data formats (including some that compromise the original data quality), and a lack of secondary data products amenable to ocean applications were among the frustrations experienced by all research groups working in the region. There was a consensus that there is a real regional (and probably national) need for a centralized (one stop) meteorological service focused to the needs of the marine community. MESA and several other large research groups in the region pointed out that many of the ingredients of this service already exist, though widely dispersed, in NOAA and, to a lesser extent, in other agencies. However, it was noted that because of the number of groups involved and their mission orientations and/or reimbursable requirements, the desired service (even on the limited MESA-scale) would be cost prohibitive, as well as a management/coordination headache.

Realizing both the practical and political limitations of rapidly achieving necessary programatic and/or reorganizational changes at the federal level, a two goal approach was decided on: (1) work with the principal governmental groups involved to achieve the best "product" possible for a narrow time span and limited area centered about the most intensive research efforts of the workshop participants (a short-term goal) and (2) utilize the results above as a prototype demonstration to lobby for the desired marine meteorological service (a longer term goal).

The AFMAB working group was thus conceived to work toward these goals.

3.1.2 Charge

1. Plan (and possibly implement) a system to assemble meteorological data sets for 1975 and 1976 * for physical oceanographic studies in the Mid-Atlantic Bight.
2. Plan improvements to the meteorological information system of the Mid-Atlantic Bight.

* As of 17 December 1976, the date of the first working group meeting, the period of initial interest was defined to be 1975 through 1977.

3. Identify and disseminate documentation of presently available meteorological information fields.
4. Within one month, develop the objectives and plan milestones and schedules.
5. Report to the 1977 Workshop on Physical Oceanography and Meteorology of the Middle Atlantic Bight, and provide feedback to participant's parent organizations.

3.1.3 Membership

Jim Allen	-	NWS/NOAA
Celso Barrientos	-	TDL/NWS/NOAA
Bob Beardsley	-	WHOI
Marshall Earle	-	NOS/NOAA
Paul Eisen	-	MESA/ERL/NOAA
John Fornshell	-	USCG
Fred Godshall **	-	CEDDA/EDS/NOAA
Merton Ingham	-	AEG/NMFS/NOAA
George Mellor	-	GFDL/ERL/NOAA
Chris Mooers	-	U. Delaware, Acting Chairman
Bob Quayle	-	NCC/EDS/NOAA
Gene Rasmusson **	-	CEDDA/EDS/NOAA

3.1.4 Current Status

A draft prospectus was developed by the working group during a series of meetings held throughout the year. The prospectus, which outlines a prototype demonstration program focused on a limited time/space domain (short-term goal), defines the meteorological requirements from a modeling point-of-view. Comments from workshop attendees and NOAA are now being incorporated into a final prospectus. Chris Mooers, acting Chairman of AFMAB, should be contacted for further information.

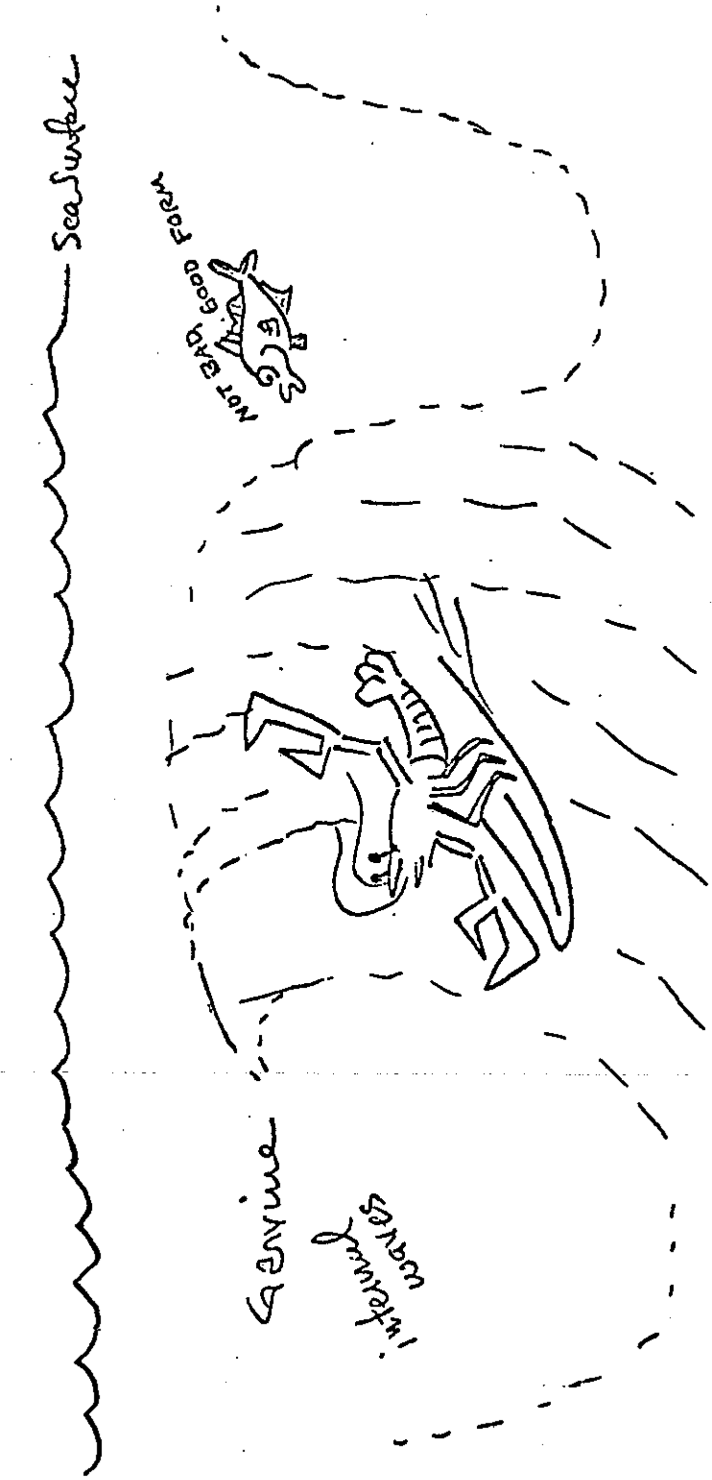
3.2 CMICE 76

Bob Beardsley gave an overview of results from the February-March 1976 current meter intercomparison experiment conducted 6 km off Shinnecock, Long Island in 28 m of water. The experiment, consisting of 20 current meters and 6 moorings of various types, was a cooperative endeavor partially planned during the 1975 workshop. The intent was to intercompare instrument/mooring systems being actively utilized by various groups conducting research in the Middle Atlantic Bight.

An "UNPUBLISHED MANUSCRIPT" entitled "CMICE 76: A Current Meter Intercomparison Experiment Conducted off Long Island in February-March 1976" has been produced as a WHOI Technical Report. Limited copies can be obtained from:

MESA New York Bight Project
Old Biology Building
State University of New York
Stony Brook, New York 11794.

** Godshall replaced Rasmusson as CEDDA representative as of 29 April 1977.


Sea Surface
NOT BAD GOOD FORM
Genuine
Internal waves

4. NEW BUSINESS

Several new topics were discussed during the workshop (mostly during the hectic closing session) and are reported below.

4.1 Atlantic Coastal Offshore Program (C. Mooers)

The East Coast Sea Grant Institutions have developed a preliminary program plan for a ten-year study of the Atlantic Offshore region. It is intended to address the needs of industrial and commercial users and governmental regulators and managers. A five-volume plan is available upon request from the Sea Grant Program, University of Delaware for a slight fee. The Executive Summary volume will be presented to the highest levels of state and federal governments in order to seek program authorization, agency assignment, and funding for a thorough planning effort. The essence of the work required is largely basic oceanographic research plus follow-through in two-way communication with the applied research and consumer communities. From another perspective, this is an attempt to roughly double the present level of effort, to cut across mission-oriented agency boundaries, and to loosely coordinate a generally fragmented aggregate of activities. The Program would work through existing agencies; however, an oversight group, the Atlantic Commission, has been proposed. It would have budgetary review authority. The probability of success is unknown and it may be a few years before the Atlantic Offshore Program's fate is settled.

4.2 National Data Buoy Office (NDBO)

Ed Karut made a short presentation of NDBO activities in the region and new systems development. The need for further NDBO CONSHELF (meteorological) buoys and additional sampling systems (e.g., surface waves, thermistor chains, current measurements, etc.) was discussed. Charles Parker mentioned that several NOAA programs had been proposed and/or are being planned for the region which could have requirements for NDBO technology and participation into the next decade. One of these is a monitoring program for the New York Bight which is being developed and tested by MESA and is tentatively scheduled for implementation by NOS in 1981. The AFMAB Working Group mentioned their recommendation for five additional air-sea interaction buoys in FY79 for the Middle Atlantic Bight and the Gulf of Maine. Much interest was expressed in the use of satellite-tracked drifting buoys, and possibly Loran C-tracked drifting buoys. A request was made for the use of a Mark III Cyclesonde in the Middle Atlantic Bight for a scientific demonstration study on shelfbreak processes.

4.3 Shelf/Slope Front Studies

Shelfbreak circulation and exchange process studies were reviewed throughout much of the workshop. It is clear that exchange occurs in association with warm-core anticyclonic eddies; wind-driven upwelling; tidal and internal gravity waves; interleaving on the microscale and fine scale; and submarine canyons. It was felt that it is premature to plan and propose a large research program. In the interim, it was thought important to document the variability and climatology of the "cold pool" for next year's workshop. The Lamont and Delaware groups did declare their intention to try some informal collaboration. They would encourage other groups to join with them; this includes biologists, chemists, and sediment transport dynamicists.

4.4 Future Workshops

The question of scheduling and siting of future workshops was entertained in the closing session. An enthusiastic response left little doubt as to the breadth and depth of support for the informal workshop format. The following volunteer hosts and schedule were tentatively agreed upon to stagger gatherings throughout the region:

1978 VIMS (Evon Ruzecki), Williamsburg, VA
1979 Marine Sciences Research Center (Malcolm Bowman), Stony Brook, NY
1980 CBI (William Boicourt), Baltimore, MD

A spirited discussion ensued on planning, conduct and documentation as well as thematic topics. A program committee was established to resolve the varied suggestions and to assist the host with workshop planning and implementation. The committee members are:

D. Hansen (convener)	AOML/NOAA
E. Ruzecki (1978 Host)	VIMS
R. Beardsley	WHOI
C. Mooers	U. of DE
C. Parker	MESA/NOAA

Since the debate was short and rapid, recording it was difficult, and all issues for consideration by the committee were not thoroughly defined. The following is the editor's attempt to list those items, both spoken and unspoken, that should be considered by the planning committee.

1. It should be remembered that the primary purpose of the informal workshop is to promote a spirit of cooperation and communication among the physical oceanographers and active programs in the Middle Atlantic Bight region.

2. "Informal" is a key word in the title. There are no formal sponsors though some modest support is available from some agencies (e.g., MESA and BNL). Even though the atmosphere is truly informal, this does not imply a totally unstructured, undisciplined gathering. Past experience has shown that for the informal workshop to function at its optimum, careful planning must precede it. A balance of firm but gentle session leadership is essential to maintain a sense of purpose and direction while preserving spontaneity. Finally, considerable

ingenuity is required to create mechanisms for collectively pooling information in the least taxing way.

3. The thematic approach seems popular. Some felt we should have fewer talks, screen speakers, and deal with fewer subjects, but in more depth. Others felt that all participants should be allowed to make presentations. A compromise was proposed: allow short presentations ("quick flashes," a maximum of 5 minutes for presentation and 5 minutes for discussion) of all major activities and results, and allow longer thematic presentations (a maximum of 20 minutes plus 10 minutes discussion). In this way screening would be employed by the committee, primarily to limit the number of long talks. Some suggested themes were modeling, cool pool research, anoxia, and products and services available within NOAA (and other agencies) that would be useful to workshop participants.

4. It has become increasingly more difficult to keep to the established workshop schedule and to conduct all the desired business. A three-day meeting, with evening topical sessions, adequate time buffers built into the schedule to allow for over-shoots, and appointment of a "time watcher" were among the suggestions to deal with this problem.

5. Workshop documentation is another topic that deserves serious committee attention. A number of approaches have been tried in the past. The most successful seems to be the short and simple abstract and activities summaries (prepared in advance). Also, the advanced preparation concept, with some preplanning and ingenuity (for simplicity sake), could be applied to cruise activity and data availability documentation (maps and time lines) which have not been presented satisfactorily to date. Graphics have been conspicuously absent from the past documentations and "major" slides (in camera-ready form) could be supplied by presentors in advance, if requested. Rapporteurs still seem necessary to record the discussions; however, it is suggested that some guidelines be established for them and that they meet with conveners immediately prior to workshop to review the guidance and work out logistics.

6. Finally, the mailing list needs updating annually. A complete list of addresses and phone numbers (both FTS and commercial for Federal employees) should be solicited at each meeting. A single column list (with ample margin for corrections) can be prepared easily from the Mag Card II format (Appendix B) and then circulated during the workshops; likewise, updating is straightforward. The committee should consider culling out any inappropriate entries from the list.

APPENDIX A.

SUMMARY OF ACTIVITIES

"One page summaries" of activities were submitted by many attendees to Don Hansen prior to the workshop. From these, Don prepared a summary of only modeling activities which was distributed to attendees along with copies of all submitted letters. The entire package was considered too lengthy for inclusion in this report; therefore, a summary (strongly filtered) of experimental activities (Part II) was produced and is included with Hansen modeling summary (Part I). A copy of the hand out package may be obtained from the MESA New York Bight Project upon request.

A seasonal/areal matrix along the lines of that produced during the 1976 workshop was circulated among the participants for indication of the coverage of their 1978 field activities and follows the above summaries.

Part I - SUMMARY OF MODELING ACTIVITIES

1. Ballentine, Robert and Lance Bogart. (SUNY, Albany)
   Atmospheric model of New England frontogenesis.
   (a) 3d, moist, nonlinear, hydrostatic, primitive
   (b) 15 km horizontal, 400 m vertical (2.5 km total)
   (c) porous sponge lateral boundary conditions
   (d) no ocean feedback - climatic SST's given.

2. Barrientos, Celso S. and Kurt W. Hess. (NOAA/NWS)
   Oil spill trajectory model.
   (a) have a "spreading-diffusion" model
   (b) will develop a "dynamical model" for near surface transports (physics not specified).

3. Blumberg, Alan and George Mellor. (Princeton U, GFD)
   Middle Atlantic Bight Model.
   (a) 3d, latitude of Hatteras, longitude of Chatham, MA
   (b) 1/4° horizontal, 20 levels vertical (bottom layer on shelf is only crudely resolved)
   (c) predicts u, v, w, T, s, and surface elevation
   (d) mixing coefficients depend on stability
   (e) a mixed bag of boundary conditions. T, s prescribed at inflow only. Seems to say either that v is determined geostrophically at boundaries or just that equations are linearized at boundaries. Surface elevation must be prescribed at all boundaries. Thinks tidal component can be handled via observations but up in the air about the mean component. Thinks out going long surface waves can be handled by a radiation condition. Surface boundaries less of a problem, no feedback with atmosphere.

4. Demenkow, Jim and David Cook. (Raytheon)
   Ocean-dumped waste dispersal models for sites south of Long Island and east of Delaware.

5. Fornskell, John and Kenneth Mooney. (Coast Guard Oceanographic Unit)
   A search and rescue model for the New York Bight.
   (a) a barotropic component from longshore slope from tidal gauge data
   (b) baroclinic component from seasonal average dynamic heights
   (c) "wind drift" component from Fleet Numerical Weather Center wind data.

6. Garfield, Newell. (U of Delaware)
   A box model of Middle Atlantic Bight circulation.
   (a) tracers used are salinity and Cs-137
   (b) estimates transports of shelf water and Gulf of Maine water and the rate of formation of shelf water.

7. Gordon, Arnold L. (L-DGO, Columbia U)
Plans for 1st order thermohaline budget modeling of the shelf-slope front.

8. Han, Gregory and D. V. Hansen. (NOAA/AOML)
Baroclinic circulation model of New York Bight (J. Galt).
(a) baroclinic component obtained from observations of density and thermal wind relation
(b) barotropic component computed, sea level prescribed at all boundaries
(c) quasi-steady state, triangular grid keyed to density observations, diagnostic
(d) tuned to match current meter observation. Has difficulty matching near-bottom and near-surface meters simultaneously
(e) Work going on to improve treatment of bottom friction (bottom Ekman layer parameterization)
(f) velocity field from this model used in O_2 transport model.

9. Hopkins, Tom. (Brookhaven National Lab)
An "analytic transform model compares real time vertical and horizontal frictional dependencies with spar buoy data." See also Tingle, Art and O'Connor, Donald J.

10. Hsueh, Phil. (FSU)
Barotropic shelf model.
(a) long wave approximation to the barotropic vorticity equation
(b) for computing bottom currents
(c) driven by winds observed at JFK airport and "by disturbances in bottom currents at two locations on Long Island shelf
(d) uses a bottom friction proportional to geostrophic bottom velocity
(e) more successful inshore than outshore.

11. Kupferman, Stuart and Kathy Bush. (U of Delaware)
A box model of Middle Atlantic Bight using salinity and heat content as the tracers. See Garfield, N.

12. Martin, Wayne and Garvine. (U of Delaware)
Plans for model of the shelf break front.

13. Mayer, Dennis. (NOAA/AOML)
Statistical analysis of current meter site. Plans for regression analysis of currents vs wind (local + more?).

14. Milford, Nevel, P. Biscaye, and S. Carson. (L-DGO, Columbia U)
3d diffusion model for predicting Rn distributions. Assumes flat bottom and diffusion rates and source/sink distribution are specified.

15. Miller, James R. (Rutgers)
A mixed layer model to explore the mixed layer development during the heating season. Studies storm and runoff dependencies. Physics unspecified.

16. O'Conner, Donald J. (Manhattan College)
A steady state advective-dispersive transport model.
(a) two layers with "39 segments" per layer. Physics not specified.
(b) aimed at analysis of summer period (July-August)
(c) plans to extend modeling to time dependent study of O_2 and phytoplankton distribution.

17. Spaulding, Malcolm and Craig Swanson. (URI)
Conducting a review of shelf modeling. Plan to pick the "best" and extend it. Ambitious plan.

18. Tingle, Art and Tom Hopkins. (Brookhaven National Lab)
A numerical, barotropic primitive equation shelf model geared to oil spill trajectories.

19. Wang, Dong-Ping. (Johns Hopkins, CBI)
Model study of coastally trapped waves and effects thereon of bottom friction.

Part II - SUMMARY OF EXPERIMENTAL ACTIVITIES

1. Austin, Herb. (VIMS; Div. of Fishery Science and Services)
Fishery oceanography in support of state's marine resource management. Examining environmental variables that produce population fluctuations in species of commercial or recreational importance to state.

2. Bowman, Malcolm. (SUNY/MSRC)
Outlines personal endeavors.
   (a) effects of Hurricane Belle on Hudson Plume Study nearing completion
   (b) conceptual (non funded) development of two-demensional cross-shelf diffusion model
   (c) organized, convened, and documented workshop on role of ocean fronts in coastal processes
   (d) plans interdisciplinary investigation of tidal stirring, frontogenesis and cyclogenesis in shallow seas.

3. Delnore, Victor E. (Rutgers U)
Proposal to "inspect" operational SEASAT data to examine instrument performance and signal transform methods utilizing available NY Bight data for sea-truth.

4. Goulet, Julien R., Jr. and Elizabeth D. Haynes. (NMFS, Fisheries Assessment Division)
Developes annual Status of Environment report covering areas of the U.S. Fishery Conservation Zone.

5. Hansen, Donald V., Gregory Han, and Dennis Mayer. (NOAA/AOML)
Continuing MESA Physical oceanographic field program - 5-6 water column (physical/chemical) surveys (~84 stations) per year covering NYB; year round current observations (~30 levels at ~10 stations); variable bottom pressure measurements. Mooring emphasis shifts closer to shore somewhat in 1978 but intensive cross-shelf transect off Shinnecock retained for diagnostic model.

6. Hunkins, Ken. (L-DGO)
Two year program (began January 1977) with twice weekly CTD-current profiling (5 or 6 station) in East River; some moored current measurements; some 24-hour, serial profiles; a high-frequency echo sounder being tested to profile density interface.

7. Ingham, Merton. (NMFS/AEG)
Outlines AEG studies.
   (a) bottom water anoxia studies
   (b) satellite I-R studies of shelf-slope fronts and warm core rings
   (c) XBT Ship of Opportunity program off NE coast
   (d) Deepwater Dumpsite 106 research
   (e) oceanographic climatological support of NMFS.

8. Magnell, Bruce. (EG&G)
Essentially completed study for the Atlantic generation station off Little Egg Inlet. Five reports summarizing results are abstracted. Moored temperature measurements continuing.

9. Orr, M. H. and F. R. Hess. (WHOI)
An acoustic backscattering system has been applied to detection and study natural mixing processes, shelf-slope intrusion, internal waves, suspended particulates, and dispersion of chemical waste at DWD-106. More planned.

10. Patchen, Richard. (NOAA/NOS)
Initial processing and tidal current analysis for MESA-NYBP.

11. Ruzecki, John. (VIMS)
Disscussed two scientific endeavors, the BLM baseline study and submarine canyon effects on shelf-slope exchange, conducted in 1977 and outlines suggested extensions to the BLM study for 1978. Physical implications and limitations of the bio/chemically defined baseline study are discussed.

12. Scott, J. T. (SUNY, Albany)
Continuing analysis of BNL data set (seasonal flow variations) and discusses problems of interest to him (viz. forcing of biological "events" by physical processes).

13. Swanson, Graig and Malcolm Spaulding. (URI/Dept. of Ocean Engineering)
Discussed an effort to link coastal circulation and pollutant dispersion models with remotely sensed and ground truth data. Are conducting a state-of-the-art, coastal modeling assessment. A model will be selected for further development and linkage.

14. Swift, D. J. P., R. A. Young, and G. L. Freeland. (NOAA/AOML)
Discusses INSTEP, a nearshore sediment transport experiment conducted off Long Island by MESA. The development of bottom boundary layer sensings and results of initial field trials are discussed as well as 1978 field work.

15. Warsh, Catherine. (NOAA/Ocean Dumping Program)
Briefly indicates NOS ocean dumping efforts at DWD-106.

Year 1978

Subarea	Winter	Spring	Summer	Autumn
Georges Bank	← BLM (Raytheon) → ← BLM (EG&G) →			
Cape Cod				← WHOI → (Beardsley & others, tentative, moored arrays, S. Channel-Nantucket Shoals)
"Block Island"				
Long Island	MESA (AOML) ←→ BNL COBOLT ←→	INSTEP Boundary Layer BNL COBOLT ←→ BNL Bio (May)	←→ MESA (AOML)	INSTEP Boundary Layer BNL Bio (?) BNL COBOLT (?)
New York Bight	← MESA (AOML) Current Moorings, Max 12 w/30 meters → ← NOS Bimonthly XBT - Acoustics from Apex to DWD-106 →	MESA (AOML) Hydro (Apr, Jun)	MESA (AOML) Hydro (Jul, Aug) L-DGO Hydro, Bio, Geo/Chem (?)	MESA (AOML) Hydro (Oct)
New Jersey	← EG&G Small Scale Dumping → ← EG&G Moored Temperature, Little Egg Inlet → VIMS Bio/Hydro (FEB-Mar)	VIMS Bio/Hydro (May-Jun)	VIMS Bio/Hydro (Aug-Sep)	VIMS Bio/Hydro (Oct-Nov)
Delmarva Peninsula				CMS Gulf Stream Front Hydro
"South Virginia"				

APPENDIX B.

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APPENDIX C.

ANNOUNCEMENT AND SCHEDULE

The following letter was mailed to the distribution list (Appendix B) on 22 September 1977. It contains an update of an announcement mailed to the same list in mid-August. Also included, is a detailed schedule of scientific presentations which was distributed at the workshop.

Lamont - Doherty Geological Observatory | Palisades, N.Y. 10964
of Columbia University

Cable: LAMONT, Palisades, New York State

Telephone: Code 914, Elmwood 9-2900
Twx: 710-576-2653

22 September 1977

Dear Colleague:

You have received from Chris Mooers the Announcement of the "Annual Informal Workshop on the Physical Oceanography and Meteorology of the Middle Atlantic and New York Bights", to be held at Lamont. The Workshop dates are 15 and 16 November 1977 (note date error on Announcement's tentative agenda).

I enclose direction to Lamont, maps of local areas (including LDGO and motels location), Lamont campus map, and motel information, to aid you in your logistics. Please fill in motel questionnaire as soon as possible and we will make the reservations.

The meeting place is in Lamont Hall (see Lamont campus map) beginning at 0830 A.M. on Tuesday 15 November. By October 15, 1977, please send

1. the required "price of admission" one page research activity summary for 1977 and research plans for 1978 to
   Dr. Donald V. Hansen
   NOAA/AOML (PHOL)
   15 Virginia Beach Drive
   Miami, Florida 33149
2. one page abstract of an oral science report (if you wish to make one) to
   Dr. Arnold L. Gordon
   Lamont-Doherty Geological Observatory
   Palisades, N.Y. 10964

(if you need any special visual aids, let me know)

Lamont campus is in quite an attractive setting, especially in the autumn. The weather should be cool and comfortable (assuming we are not in the midst of a hurricane). I look forward to meeting you and to a productive meeting.

Sincerely,

Arnold L. Gordon

Arnold L. Gordon

A N N O U N C E M E N T

Topic: Annual Informal Workshop on the Physical Oceanography and Meteorology of the Middle Atlantic and New York Bights

Place: Lamont/Doherty Geological Observatory, Columbia University, Palisades, NY 10964

Host: Dr. Arnold L. Gordon (he will mail logistical information to you)

Dates: Tuesday and Wednesday, 15 and 16 November 1977

Sponsors: New York Bight Project Office
Brookhaven National Laboratory

Groundrules:

(1) The required "price of legitimate participation" is a one page research activity summary for CY1977 and research plans for CY1978 in the topical area, to be sent to

Dr. Donald V. Hansen
NOAA/AOML (PHOL)
15 Virginia Beach Drive
Miami, Florida 33149

(305) 361-5761

by 15 October 1977

(2) If you wish to give an oral scientific report, you must send a one page abstract to

Dr. Arnold L. Gordon
Lamont/Doherty Geological Observatory
Columbia University
Palisades, NY 10964

(914) 359-2900 Ext. 325

by 15 October 1977

Notes:

(1) The N. Y. Bight Project Office is planning to document the Workshop with a technical memorandum; Mr. C. A. Parker has prepared an on-line documentation scheme.

(2) The theme is Modeling of the Middle Atlantic Shelf Circulation; there is scope for the presentation of observations of use to, or which challenge, modelers as well as models per se.

(3) Attendees pay their own way.

Tentative Agenda:*

15 November, Tuesday

0830 - Welcome to L/DGO, Dr. Arnold Gordon

0900 - Summary of CY1977 research and CY1978 activities, Dr. Donald Hansen

1000 - Coffee break

1030 - Introduction to the scientific theme: Modeling of the Middle Atlantic Shelf Circulation - Dr. George Mellor

1100 - Commence scientific reports

1200 - Lunch

1330 - Continue scientific reports

1500 - Coffee break

1530 - Continue

1700 - Recess

16 November, Wednesday

0830 - Continue scientific reports

1000 - Coffee break

1030 - Report from Working Group on Atmospheric Forcing of the Middle Atlantic Bight -Dr. Chris Mooers

1115 - Report on Current Meter Intercomparison Experiment (CMICE) - Dr. Bob Bearsley

1200 - Lunch

1330 - Discussion of future shelfbreak process studies, led by Dr. Arnold Gordon

1430 - Report on the Atlantic Coastal Oceanographic Program Workshop - Drs. Gabe Csanady and Chris Mooers

1500 - Coffee break

1530 - Reconvene if there are anymore special reports or discussions

≤ 1700 - Adjourn

*Presumably, a tour of L/DGO facilities can be sandwiched in some place.

MIDDLE ATLANTIC BIGHT WORKSHOP - November 15 and 16, 1977.

SCIENTIFIC PRESENTATIONS

15 November 1977, Tuesday

11:00-11:15	Dr. Dennis A. Mayer, NOAA/AOML/PhOL "Long Term Current Variability in a Midshelf Region Above the Hudson Shelf Valley"
11:15-11:30	Dr. John C. Van Leer, School of Mar. Atmos. Sci. Univ. of Miami "Cyclesonde Measurements in the New York Bight"
11:30-11:45	Dr. Gregory Han and Dr. Donald V. Hansen NOAA/AOML/PhOL, Miami, Florida "Diagnostic Model of Water and Oxygen Transport in the New York Bight"
11:45-12:00	Dr. M.R. Orr and Dr. F.R. Hess, Woods Hole Oceanogr. Inst. "Remote Acoustic Sensing of Physical Processes"
	LUNCH
13:30-13:45	Dr. Arnold L. Gordon, Lamont-Doherty Geol. Obs. "Shelf-Slope Exchange"
13:45-14:00	Dr. Robert W. Houghton, Lamont-Doherty Geol. Obs. "Time and Space Variability of Interleaving Structure at the Shelf Break in the New York Bight"
14:00-14:15	Drs Robert Williams, Fredric Godshall, and Joseph Bishop, Center for Experimental Design and Data Analysis/ EDS/NOAA -- "Oceanographic Analyses from Data in the National Archives"
14:15-14:30	Dr. Christopher N.K. Mooers, College of Marine Studies, Univ. of Delaware, Lewes, Del. "Synoptic Study of the Shelf Water/Slope Water Front's Mesoscale Structure"
14:30-14:45	Dr. Wayne W. Martin, Coll. of Mar. Studies, U. Del. "Hydrographic Reconnaisance of the Wilmington Canyon's Impact on the Shelf Water/Slope Water Front"
14:45-15:00	Dr. Richard W. Garvine, Coll. of Mar. Studies, U. Del. "Small Scale Study of the Shelf Water/Slope Water Front's Convergence Zone"
15:00-15:15	Dr. George R. Halliwell, Jr., Coll. of Mar. Studies, U. Delaware "Forcing Mechanisms of the Shelf-Slope Front from the Chesapeake Bay Through Georges Bank"

15:45-16:00 Dr. Pierre E. Biscaye and Steven R. Carson, Lamont-Doherty Geol. Obs.
"Distributions of Dissolved Rn-222 and Suspended Particulates"

16:00-16:15 Dr. J. Lockwood Chamberlin, National Marine Fisheries Service, Narragansett, R.I.
"Strong Gulf Stream Eddy Currents Indicated by Losses of Crab Traps on the Continental Slope"

16:15-16:30 Drs N. Arthur Pore and Celso S. Barrientos, Techniques Development Lab., Nat'l Weather Service
"Operational Marine Environmental Prediction Programs of the Techniques Development Laboratory (AFMAB)"

16:30-16:45 Dr. Kurt W. Hess, Techniques Development Lab., Nat'l Weather Service
"Oil Spill Trajectory Forecast"

16:45-17:00 Dr. Y. Hsueh, Dept. Oceanogr., Florida State Univ.
"Long Wave Models of Currents in New York Bight"

16 November 1977, Wednesday

8:30-8:45 Dr. Dong-Ping Wang, Chesapeake Bay Institute, The Johns Hopkins University, Baltimore, Md.
"Coastal Water Variability on the Mid-Atlantic Bight"

8:45-9:00 Dr. Stuart Kupferman, Coll. of Mar. Studies, U. Del. Newark, Del.
"Further Studies of the Circulation in the Middle Atlantic Bight Using Box Models"

9:00-9:15 Dr. Malcolm J. Bowman, SUNY at Stony Brook, N.Y.
"Two-dimensional Cross-Shelf Diffusion Model of New York Bight"

9:15-9:30 Dr. Merton C. Ingham, National Marine Fisheries Serv., Narragansett, R.I.
"Efforts of the Atlantic Environmental Group to Construct an Environmental Data Base for Fishery Climatology Studies in the Cape Cod-Cape Hatteras Area"

9:30-9:45 Drs. Alan F. Blumberg and George L. Mellor, Geophysical Fluid Dynamics Program, Princeton Univ.
""Progress in the Development of a Three-dimensional Baroclinic Model of the MAB"

9:45-10:00 Dr. Eric Posmentier, CUNY.
"Fine structure and Instability in the Shelf/Slope Front"

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